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United States Department of Agriculture.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

COOPERATIVE RANGE GRASS AND FORAGE PLANT EXPERIMENTS AT
HIGHMORE, S. DAK.

INTRODUCTORY.

In the early part of the present year the Secretary of Agriculture received a communication from Director Shepard of the South Dakota Experiment Station, asking the cooperation of the Department with that station in a series of experiments with drought-resisting grasses and forage crops with a view to finding varieties suitable for use in the range regions. Through Professor Shepard the South Dakota authorities made a proposition to furnish land for the experiments and properly equip the Station, asking the assistance of the Department of Agriculture in planning, instituting, and carrying on the experiments.

The proposition meeting the approval of the Secretary of Agriculture, Mr. Thomas A. Williams of the Division force was sent to South Dakota with instructions to complete the arrangements for cooperation and to assist the authorities of the South Dakota Station in planning and instituting experiments for testing such drought-resisting grass and forage crops as seem likely to be of value on the northwestern ranges.

The results of the work for the first season are most satisfactory both as to the plan of cooperation and the tests undertaken. The authorities of the South Dakota Experiment Station and also of the State Agricultural College are doing all in their power to make the work a success. The same can be said of the people of that section who are interested in the question of forage supply. The cordiality with which all parties have entered into this work, the representative character of the site selected for the Station as to both soil and climatic conditions, and the practical nature of the experiments, give every promise that the results accomplished will be of great value to the people of the northwestern range region.

Mr. Louis W. Carter, a graduate of the South Dakota Agricultural College, was appointed special agent on the rolls of the Division and placed in charge of these cooperative experiments and the results of the work of the present season are appended.

The grounds of the Highmore Cooperative Grass and Forage Plant Experiment Station consist of one hundred and seventeen acres, being that part of section eleven, town one hundred and twelve north, range seventy-two east, lying north of the Chicago and Northwestern Railroad. This land was deeded to the South Dakota Ex-

periment Station by the people of the county in which Highmore is situated for the purpose of testing dry-land grasses and forage plants and experiments in range renovation. The soil of the land selected and the climatic conditions are fairly representative of the great range region of western Nebraska, South Dakota, North Dakota, Wyoming, and Montana. It is on the high rolling prairie which separates the valleys of the Missouri and James rivers and about equidistant from each. The soil is a rich, sandy loam containing little or no alkali and, with sufficient moisture, would produce good yields of the ordinary farm crops. The subsoil is the yellow boulder clay characteristic of the drift soils in the Northwest. The Station is equipped with a seed house 14 by 22 feet, 1½ stories high, with a lean-to 14 by 22 feet for a tool shed, a cistern and the necessary tools for planting and cultivating the crops.

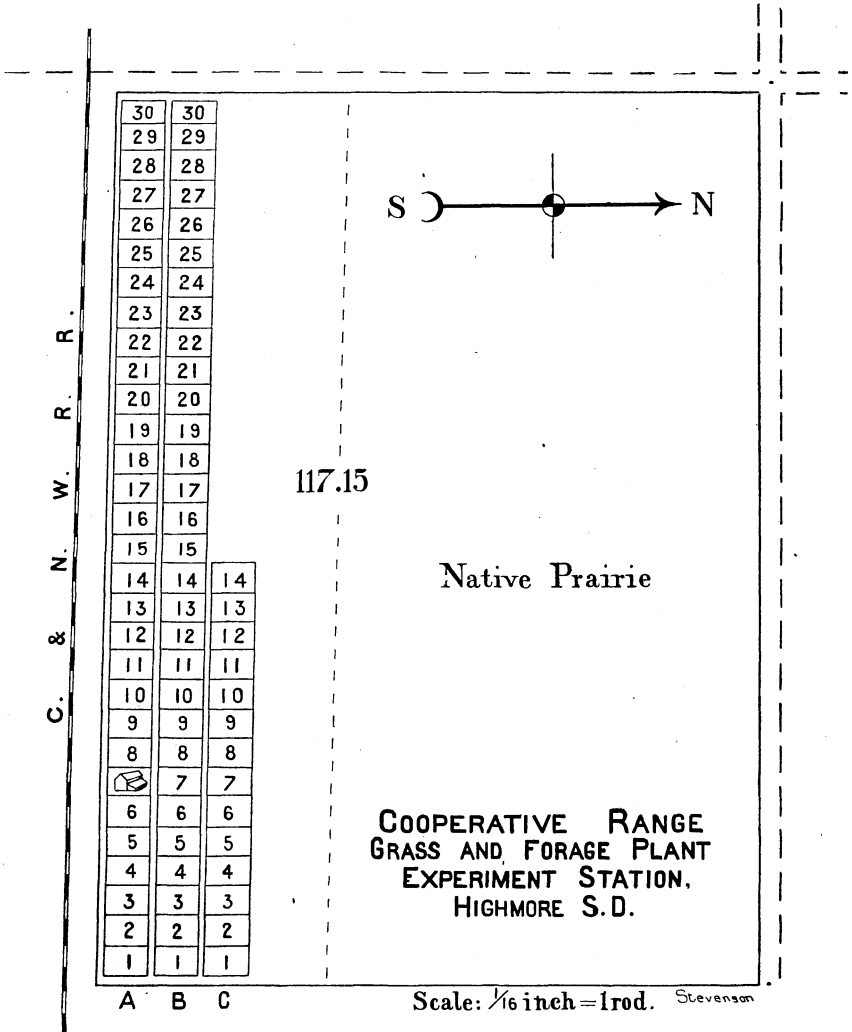
Between 40 and 50 acres lying close to the railroad were broken up in 1884 and 1885 and cultivated for a number of years. This land was then left idle and grew up to weeds and native grasses or "went back," as the common saying is. It had not been plowed for six or seven years. Beginning on the south side, series of plats were laid off, each series being eight rods wide. These were again divided into quarter-acre plats, each plat being 5 by 8 rods, and numbered consecutively, beginning at the east. There are 30 plats in each series. The series are lettered A, B, C, etc. Series A and B and about one-half of series C were plowed 6 inches in depth with a common stirring plow. About thirty permanent plats were sown. Most of these made a good growth but those sown broadcast are mixed with the native grasses, western wheat grass (*Agropyron spicatum*) being most prevalent. Quite a number of annuals were planted and the rest of the ground plowed was sown to millet or planted to corn to keep the weeds down.

Rain and snowfall at Highmore, S. Dak., for the years 1897, 1898, 1899, as observed by Mr. J. C. Stoner.

1897.			1898.			1899.		
Month.	Rain or snow.	Inches.	Month.	Rain or snow.	Inches.	Month.	Rain or snow.	Inches.
February	Snow ..	8.	February ..	Snow ..	2.	January ...	Snow ...	2.6
March	do	11.	March	Rain ...	1.40	February ...	Rain ...	.11
	Rain ...	1.6	April	do	1.51	February ...	Snow ...	.50
April	Snow ...	13.	May	do	4.17	March	Snow ...	14.50
	Rain ...	2.32	June	do	1.67	April	do	6.
May	Rain ...	.51	July	do	2.33	April	Rain ...	1.4
June	do	2.79	August	do ....	.62	May	Snow ...	.5
July	do	3.75				May	Rain ...	3.75
August	do	1.45				June	do	4.2
September	do ....	.41	Rest of year missing.			July	do	1.81
October	Snow ...	2.				August	do	2.19
	Rain ...	1.05	Total, Feb. to Sept. 1:			September ..	do ....	.48
November	Snow ...	4.				October	do ....	.84
	Rain ...	.08	Snow, 2. inches. Rain, 11.70 inches.			Total to October 22: Snow, 23.6 inches. Rain, 14.67 inches.		
December	Snow ...	3.5						
Total	Snow ...	41.5						
	Rain ...	13.88						

NOTES ON THE PLATS.

PLAT A (1).—Thirty-four rows on the east side of this plat were sown to smooth bunch grass (*Poa levigata*). Seed collected by Shear and Bessey in Colorado in 1898. Part of the seed was sown broadcast and part of it was drilled. Very little of the seed germinated on the ground sown broadcast, and this was pulverized June 30 to destroy weeds. The seed drilled did not make a very good stand, but made a healthy growth. Seed sown May 10; sprouted and up May 23; October 23, the plants were two to three inches high and still green.



Ten rows on the west side of this plat were drilled to bunch redtop (*Poa buckleyana*). Seed sown May 10; sprouted and up May 26. All the young plants were destroyed by drought, and the ground was cleaned of weeds June 30.

PLAT A (2).—The east half of this plat was planted to bunch grass (*Poa* sp. ?), the seed of which was collected in Wyoming by Mr. Griffiths in July, 1898. Sown broadcast May 10; sprouted and up May 31. The stand is very thin.

The west half of this plat was sown in a like manner to a robust form of Canadian blue grass (*Poa compressa*), collected by Mr. Griffiths at Norfolk, Nebraska, in 1898. Sown May 10; up May 31. Stand thin.

PLAT A (3).—Nevada blue grass (*Poa nevadensis*). One-half of this plat was drilled and the other half sown broadcast. Seed collected by Williams and Griffiths in Wyoming in 1898. Sown May 10; sprouted and up May 31. The stand on part of the drilled portion was so thin it was sown to millet to keep weeds down. The part left made a good, healthy growth. The stand on the part of plat sown broadcast was also very thin. Mown July 29 to kill weeds. October 23, the plants were two to three inches high and still green.

PLAT A (4).—Oregon brome (*Bromus unioloides*). This plat was sown broadcast May 10. Seed from Oregon. Sprouted and up May 22. This seed germinated well, but the plat was very weedy. August 5, it was twelve to eighteen inches high; August 21, seed was ripe and one-half bushel gathered by hand; October 23, six to eight inches high and still green.

PLAT A (5).—The last row on the west side of the plat was sown to Buffalo bunch grass (*Festuca scabrella*). Seed collected by Shear and Bessey in Colorado in 1898. Seed sprouted, but the young plants died as a result of the drought.

The second row from the west was sown to Langsdorff's reed-bent grass (*Calamagrostis langsdorffii*). Seed failed to germinate.

Six rows near the west side of this plat were drilled to Safflower (*Carthamus tinctorius*). Seed drilled May 10; sprouted and up May 21. Seed came from Professor Hansen, of the South Dakota Agricultural College. Grew to be two or three feet high. Seed ripened in September. This plant is grown in Russia for the oil extracted from the seed.

Rows 9 and 10 from the west were sown to "Pajsa" No. 493. Seed failed to germinate.

The east four-fifths of this plat were sown broadcast to short-awned brome grass (*Bromus breviaristatus*). Seed collected by Mr. Griffiths in Wyoming in 1898. Sown May 10; sprouted and up May 24. The plat was mowed July 29 to kill weeds. This grass made a good stand, and on October 23 it was two to three inches high and still green.

PLAT A (6).—This plat was drilled to King's fescue (*Festuca kingii*). Seed collected by Williams and Griffiths in Wyoming in 1898. Sown May 12; sprouted and up May 24. This grass made a good stand. The dry weather did not seem to affect it. October 23, the plants were three to four inches high and still bright green.

PLAT A (7).—This plat was selected as a site for the seed house and only part of it sown to three kinds of imported millets. Two of these failed to germinate. The millet that grew was a black broom-corn millet (South Dakota Experiment Station No. H-9). This millet made a good growth, 24 to 30 inches in height, and was not badly affected by the dry weather; ripened, and was cut August 12. It yielded a quantity of seed but no reliable estimate of the yield per acre could be made on such a small piece of ground. This is evidently the same as the millet grown on plat C-12.

PLAT A (8).—The first four rows on the east side of this plat were sown to the woodland rye-grass (*Elymus glaucus*). Seed collected by Williams and Griffiths in 1898. Drilled May 11; sprouted and up May 28. August 5 it was eight to ten inches high and of a bright green color. October 24 still bright green. The fifth and sixth rows in this plat were drilled to bearded wheat grass (*Agropyron caninum*). Seed collected by Shear and Bessey in Colorado in 1898. Seed drilled May 11, but failed to germinate.

The seventh, eighth, and ninth rows were drilled to bearded wheat grass. Seed from U. S. Grass Garden in 1896. Failed to germinate. The next nine and one-half yards east of drilled portion were sown broadcast May 13 to feather bunch grass (*Stipa viridula*). Seed collected by Griffiths in South Dakota 1898. Sprouted and up May 30. Stand thin, mown July 29 to kill weeds.

The east half of this plat was sown broadcast to bearded wheat grass (*Agropyron caninum*). Seed collected by Williams and Griffiths in 1898 in Wyoming. Seed sown May 11; sprouted and up May 25. Fair stand. Mown July 29 to kill weeds. October 23, curing on the ground but still green at the bottom.

PLAT A (9).—This plat was drilled May 11 to giant rye-grass (*Elymus condensatus*). Seed collected by Williams and Griffiths in Wyoming in 1898. Sprouted and up May 24. July 26, ten inches high. August 5, twelve inches high and very badly rusted. October 24, leaves all dead, killed by frosts.

PLAT A (10).—This plat was sown broadcast to six lots of slender wheat grass (*Agropyron tenerum*). Five of these were collected by Williams and Griffiths in Wyoming and Montana and one lot by Shear and Bessey in Colorado. They all made a fine stand. No difference could be detected this year. Seed sown May 13; sprouted and up May 22. Mown July 29 to kill weeds. October 24, not very high but still green.

PLAT A (11).—This plat was drilled to slender wheat grass (*Agropyron tenerum*). Seed collected by Shear and Bessey in Colorado in 1898. Drilled May 12; sprouted and up May 28. There was a great difference in parts of this plat. July 26, six inches high; some heading out. August 5, first five rows headed out, twelve to fourteen inches high. In the next twenty rows the plants are darker green, smaller, and later, just beginning to head out. Rest of plat same as first five rows. October 24, rusted badly but still partly green.

PLAT A (12).—This plat was sown broadcast to wild timothy (*Muhlenbergia racemosa*). Sown May 11; sprouted and up June 6. August 5, three to four inches high; very thin stand and very weedy. Mown July 31 to kill weeds. October 24, all dead, killed by frosts.

PLAT A (13).—Eight yards on the east side of this plat were sown to curly mesquite (*Hilaria cenchroides*). Sown broadcast May 11; sprouted and up June 1. Very thin stand. Mown July 31 to kill weeds. ✓

✓ The next eight yards of this plat were sown broadcast to blue grama (*Bouteloua oligostachya*). Seed collected by Williams and Griffiths at Billings, Montana, 1898. Seed sown May 11; sprouted and up May 27. Stand thin and plat weedy.

The next five yards in this plat were sown broadcast to blue grama (*Bouteloua oligostachya*). Seed collected by Williams and Griffiths, Montana, 1898. Seed sown May 11; sprouted and up June 4. Mown July 31 to kill weeds. Thin stand.

The rest of this plat, four paces, was sown to King's fescue (*Festuca kingii*). Seed collected by Williams and Griffiths in Wyoming, 1898. Sown broadcast May 13; sprouted and up May 26. Plat was mown July 31 to kill weeds.

PLAT A (14).—Blue grama (*Bouteloua oligostachya*). Seed on the west half of plat came from Walla Walla, Wash. Sown broadcast May 11. Thin stand. Mown July 31 to kill weeds.

PLAT A (15).—Mixed grama. Seed from Texas. Sown broadcast May 11; sprouted and up June 8. Thin stand. Mown July 31 to kill weeds.

PLAT A (16).—First, twenty-two rows on east side drilled to false couch grass (*Agropyron pseudorepens*). Seed from Texas. Drilled May 12; seed failed to germinate. The next eleven rows were sown to annual saltbush (*Atriplex holocarpa*). Seed grown in U. S. Grass Garden, at Washington, in 1898. Drilled May 12; seed failed to germinate.

The next twenty-four rows in this plat were sown to silvery saltbush (*Atriplex argentea*). Seed collected by Williams and Griffiths in Montana, 1898. Drilled May 12; seed failed to germinate.

The last six yards on west side of plat were sown broadcast to wire bunch grass (*Agropyron divergens*). Seed collected by Williams and Griffiths in Wyoming in 1898. Sown May 13. Thin stand. Mown July 31 to kill weeds. October 24, three to four inches high and still green.

PLAT A (17 and 18).—Hairy or sand vetch (*Vicia villosa*). Seed imported from Russia by the U. S. Department of Agriculture. Drilled May 12; sprouted and up May 26. Sown too thick; nearly every seed germinated. July 26, two to four feet long. Almost all killed by hot winds July 15 to 20. Very weedy. Around the edges next to paths it made a good growth and blossomed in August and September, but failed to mature seeds. October 24, still green and would make good pasture.

PLAT A (19 and 20).—Sown broadcast May 23 to Turkistan alfalfa (*Medicago sativa* var. *turkestanica*). Seed from Section of Seed and Plant Introduction, No. 991. Sprouted and up May 29. The alfalfa grew nicely until the first of July, when it was six to eight inches tall. The dry weather in July and August stopped the growth and damaged it badly.

PLAT A (22 and 23).—Western wheat grass (*Agropyron spicatum*). Seed collected by Williams and Griffiths in Wyoming in 1898. Sown broadcast May 11; sprouted and up June 4. Mown July 31 to kill weeds. Good stand. October 24, three to four inches high and still green.

PLAT A (21 and 24 to 29, inclusive).—Were sown broadcast May 10 to smooth brome grass (*Bromus inermis*). Seed grown at the South Dakota Experiment Station, at Brookings, S. Dak. Sprouted and up May 21. July 26, good stand from four to six inches tall. Mown July 31 to kill weeds. October 24, still green, five to six inches high and very thrifty. This grass has made the best showing of any of the grasses sown broadcast.

PLAT B (1).—Original prairie. Broken in June. Not planted.

PLAT B (2).—North half of this plat was drilled to Hagi (*Lespedeza bicolor*), introduced from Japan by the Section of Seed and Plant Introduction. Very thin stand. Grew to be twenty-four to thirty inches high but did not come into bloom. Had a single stalk and was very woody.

PLAT B (3).—Earliest ripe fodder corn. Seed from J. A. Salzer Seed Co. Planted in rows 22 inches apart, May 24. Sprouted and up June 1. Part of this plat was drilled, part planted in hills 14, 28, and 42 inches apart in the rows. The drilled portion suffered from drought in July and only grew to be from two to three feet high. The thinnest planting made the coarsest fodder and the yield seemed to be heavier. The wind blew the corn together so that the different sections of plat could not be weighed separately. Tasseled July 27. Cut September 11. Weighed October 20.

Yield on one-quarter acre 400 pounds, or at the rate of 1,600 pounds per acre. This plat is on some of the lowest ground under cultivation. The tallest corn was from three and one-half to four feet high.

Four rows on the west side of this plat were sown to yellow milo maize. Seed furnished by Mr. J. C. Stoner, of Highmore. It was old and failed to germinate.

PLAT B (4).—Salzer's Superior fodder corn. Seed furnished by J. A. Salzer Seed Co. Planted May 24 in rows 22 inches apart, hills 14, 28, and 42 inches apart in the row. As in the preceding plat the corn planted farthest apart made the largest growth. Sprouted and up June 1. July 27, three to four feet high. Very rank growth. Most of it tasseled out before September 1. Cut September 11. Four to seven feet high. Weighed October 20; weight for one-quarter acre 810 pounds, or at the rate of 3,240 pounds per acre.

PLAT B (5, 6, 7, and 8).—Sown broadcast to Turkestan alfalfa (*Medicago sativa* var. *turkestanica*) at the rate of 25 pounds per acre. Seed from Section of Seed and Plant Introduction, No. 991. Sown May 21. Sprouted and up May 27. Made a fine growth up to July 4. Badly damaged by hot winds July 15 to 20. Six to ten inches high July 1. Did not grow any taller. Still alive and fresh October 24.

PLAT B (9).—Earliest ripe fodder corn. Seed from J. A. Salzer Seed Co. Planted May 24, in hills 42 inches apart. Sprouted and up June 2. July 27, three to four feet high. Thin stand. Cut September 11. Had quite a number of small ears. Weighed October 20; weight, dry fodder, 310 pounds, or at the rate of 1,240 pounds per acre. This fodder was badly blown about by the winds.

PLAT B (10).—Jerusalem corn. Seed from J. A. Salzer Seed Co. Half of this plat was drilled and half sown broadcast. Stand was thin, seed did not germinate well. Three rows on east side of plat were left to ripen seed and yielded one peck. Ripened in September. The corn on part of plat sown broadcast grew to be two or three feet high; that drilled, three to four feet. Cut September 11. Weight estimated 300 pounds or at the rate of 1,200 pounds per acre.

PLAT B (11).—Salzer's Superior fodder corn. Seed from J. A. Salzer Seed Co. Planted in hills 42 inches apart May 24. Sprouted and up May 31. Made a good growth. July 27 was four feet high. Cut September 12; five to six feet high at time of cutting. Weight October 20, 500 pounds, or at the rate of 2,000 pounds per acre. The land being higher than plat B (4), this corn did not make as thrifty a growth as on that plat.

PLAT B (12).—East half of plat planted to Wisconsin amber cane. Seed from J. A. Salzer Seed Co. Drilled May 25; sprouted and up June 14. About 75 per cent of a stand. July 27, two and one-half to three feet tall; badly damaged by hot winds. Cut September 13. Three rows left to ripen seed. About one-half was badly affected by smut.

PLAT B (12).—West half of plat planted to hairy vetch (*Vicia villosa*) and Jerusalem corn. Sown broadcast May 25. Vetch sprouted and up June 2; corn sprouted and up June 8. Badly damaged by drought in July; very weedy. September 1, corn and vetch dead except a little near the edges of the plat.

PLAT B (13).—East half of plat. Dwarf Victoria rape. Drilled in rows one foot apart May 25; sprouted and up May 30. Seed sown too thick. July 27, one to one and one-half feet high. Did not grow any after July. Yield, four to five tons of green fodder per acre.

PLAT B (13).—West half of plat. Dwarf Victoria rape and Wisconsin amber cane. Sown broadcast May 25; rape sprouted and up June 2; cane sprouted and up June 13. Plat was sown too thick; cane all died. Rape six inches high. Rape did not grow any after July.

PLAT B (14).—Salzer's Superior sand vetch (*Vicia villosa*). East half of plat sown in drills two feet apart; west half of plat sown broadcast. Sown May 25; sprouted and up May 31. July 27, drilled portion, one to one and one-half feet long; did not grow any more. That sown broadcast died from hot winds in July.

PLAT B (15).—Salzer's Superior fodder corn. Seed from J. A. Salzer Seed Co. Planted in hills 42 inches apart May 25; sprouted and up June 4. July 27, 75 per cent of a stand; four feet high. Cut September 13; five to six feet high. Weight, October 10, 500 pounds, or at the rate of 2,000 pounds per acre.

✓ PLAT B (16).—Earliest ripe fodder corn. Seed from J. A. Salzer Seed Co. Drilled May 25, in rows 42 inches apart; sprouted and up June 3. Tasseled out, July 27; three to three and one-half feet high. Cut September 11. A few ears of corn on stalks. Weight, October 20, 300 pounds, or at the rate of 1,200 pounds per acre.

PLAT B (17).—Hairy vetch (*Vicia villosa*). East half of plat drilled; west half sown broadcast. Sown May 26; sprouted and up May 30. July 27, in blossom; one to two feet long on drilled portion. Part of plat sown broadcast, dried out and destroyed by dry weather. A few plants next to paths made a good growth and blossomed, but did not mature seeds.

PLAT B (18).—Kafir corn. Seed from J. A. Salzer Seed Co. Half of plat drilled and half sown broadcast. Sown May 26; sprouted and up June 12. Germination poor. Portion sown broadcast killed by weeds and dry weather. Drilled corn two to two and one-half feet high; part of it left for seed, part cut September 13. None of that left for seed filled. Weighed October 20; yield at the rate of 1,500 pounds per acre.

PLAT B (19).—Combination plat—sand vetch, alfalfa, and Kafir corn. Sown broadcast and drilled May 26; sprouted and up June 1. Portion sown broadcast dried out and died. July 27, drilled portion—corn, two feet high; vetch, one to two feet long; alfalfa, eight to ten inches. Did not grow any after July. October 20, alfalfa and sand vetch still green but not growing.

The rest of Series B was planted to fodder corn and cultivated to keep the ground clean.

PLAT C (1 and 2).—New breaking, not planted.

PLAT C (3 to 6).—Common millet (*Chetochloa italica*). Sown for feed at the rate of twelve quarts per acre. Sown June 7. Sprouted and up June 16. These plats were on low ground and the millet made a good growth one to two feet high. Cut for hay August 8. Yield 2,961 pounds.

PLAT C (7 to 10, inclusive).—One acre. Common millet (*Chetochloa italica*). Sown at the rate of sixteen quarts per acre. Sown June 7. Sprouted and up June 16. Cut for hay August 8. This millet was on high ground and suffered badly from drought in July. Yield 1,740 pounds.

PLAT C (12).—Red Orenburg broom-corn millet (*Panicum miliaceum*). Seed from Section of Seed and Plant Introduction, No. 2960. Sixteen rows on east side of plat drilled June 16. Sprouted and up June 23. Very poor germination. July 27, one and one-half feet high; low and spreading; seed red; heads compact and heavily seeded. About two quarts of seed were saved of this variety.

PLAT C (12).—Black Russian broom-corn millet (*Panicum miliaceum*). Seed from Section of Seed and Plant Introduction, No. 2795. Eighteen rows drilled June 16. July 27, one and one-half feet high; very rank grower. September 1, two to two and one-half feet high. Seed ripe. This is a black-seeded millet and the best of the Russian millets tried. One and one-half quarts of seed were raised.

PLAT C (12).—Red Veronezh broom-corn millet (*Panicum miliaceum*). Seed from the Section of Seed and Plant Introduction, No. 2796. Twenty-five rows drilled June 16. Poor germination. July 27 one and one-half feet high. Plants low and spreading; heads long; seed red. Three quarts of seed were raised.

PLAT C (13).—Tambov broom-corn millet (*Panicum milaceum*). Seed from Section of Seed and Plant Introduction, No. 2794. Fifteen rows drilled June 16. Sprouted and up June 23. Very poor germination of seeds. July 27, headed out, one foot high. Plants low and spreading. Two quarts of seed raised from this number.

PLAT C (13).—Red Russian broom-corn millet (*Panicum miliaceum*). Seed from the Section of Seed and Plant Introduction, No. 2797. Fourteen rows drilled June 16. Sprouted and up June 23. Poor germination. July 27, headed out, one and one-half feet high. Heads long and spreading; seed red. Two quarts of seed of this millet were saved.

PLAT C (14).—Kursk millet (*Chaetochloa italica*). Seed from the Section of Seed and Plant Introduction, No. 2798. Thirty-one rows drilled June 16. Sprouted and up June 24. July 27, very thick; one foot high. August 1, headed out sixteen to eighteen inches high. Damaged somewhat by hot winds. Heads one to three inches long. Eight quarts of seed were saved.

SUMMARY.

The preceding notes record the results of the season's work at Highmore, S. Dak. There are a few conditions which must be kept in mind in studying the results. The land slopes from west toward the east, the west side of the Station being a dry ridge. The land had "gone back" and had not been plowed for six or seven years and had become full of foul seeds. Russian thistles, pigeon grass, and western wheat grass had complete possession of the ground. The plats sown broadcast could not be weeded and the young plants had to contend against the weeds without aid. The annuals (corn, rape, vetches, etc.) did not yield as well as they undoubtedly would have, had the ground been cultivated for the past four or five years. The land was packed from the trampling of stock and when plowed was lumpy and could not be made into a satisfactory seed bed in so short a time. The season also was peculiar. A study of the moisture records will show that while there was the usual amount of rainfall it came early and late in the season and July was both dry and windy.

The pressing need of this section of the country is winter feed, either hay, fodder, or pasture. Some of the bunch grasses from the higher altitudes in Wyoming and Montana, such as bunch redtop (*Poa buckleyana*) and smooth bunch grass (*Poa laevigata*) give much promise for winter pasture, while Nevada blue grass (*Poa nevadensis*) and King's fescue (*Festuca kingii*) give promise of both hay and pasture. The frost does not affect them until very late in the season. The favorable growth and behavior of smooth brome grass (*Bromus inermis*) this year as well as previous experience here and elsewhere in the Northwest with this grass shows it to be a good hay and pasture grass. On the highest, driest ground of the Station it made a good stand and kept green and thrifty during the driest weather. Oregon brome has made a fine showing and deserves a thorough trial on account of its excellent yield of seed and forage, and drought-resistant qualities. The native wheat grasses furnish the larger percentage of the hay in this section and under cultivation and favorable conditions will undoubtedly increase in productiveness.

One of the results of the investigation of the forage problem of the northwestern ranges is a demonstration of the need of united and continued effort along the line of experimentation designed to test the adaptability of the various native and introduced grass and

forage crops to the conditions which prevail on the ranges, to learn more as to the best methods of growing these crops and of improving and maintaining the general productiveness of the ranges themselves. Much can be accomplished by the individual efforts of the ranchmen and others concerned; but all will agree that the best results can be secured only through the united, systematically planned investigations of the representatives of the General Government and the State experiment stations in close cooperation with the farmers and ranchmen. The grass and forage plant investigations at Highmore, South Dakota, are being conducted along these lines, and the results are highly gratifying.

Some of the millets introduced from the plains of Russia, and some of the varieties of sorghum and fodder corn, indicate the possibility of obtaining profitable returns in forage for winter use. With varieties sufficiently hardy to withstand the drought, or early enough to produce a crop of forage before the drought begins, the question of winter feed will be settled and the production of milk and butter through the winter months assured. By the cultivation of a relatively small area of land to these crops, the ranchman can produce enough forage to bring his stock safely through the winter, and the native pastures and meadows will be left in much better condition because of the lighter drain on their resources.

One point can not be too much emphasized, and that is the careful handling of the range so as to keep it up to the highest limit of productiveness. Experiments in range renovation have begun by properly fencing the Station grounds. The difference already seen where there has been a summer's rest, should be an object lesson to every stockman. Experiments along different lines will be carried on next season, such as scarifying and sowing grass seeds on the native sod and scarifying alone.

F. LAMSON-SCRIBNER,
Agrostologist.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., December 20, 1899.